

What is claimed is:

1. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

shock absorbing means located at a contact position where said reinforce roller and said guide plate contact each other.

2. The finisher as claimed in claim 1, wherein said shock absorbing means comprises an elastic projection protruding from part of a circumferential surface of said reinforce roller that does not contact the stack.

3. The finisher as claimed in claim 2, wherein said projection comprises a flange-like member protruding from a side of said reinforce roller over the circumferential surface of said reinforce roller.

4. The finisher as claimed in claim 1, wherein said shock absorbing means comprises an elastic strip provided

on a surface of said guide plate along the fold of the stack.

5. The finisher as claimed in claim 1, further comprising control means for causing said reinforce roller to reinforce the fold of the stack during each of a forward and a backward movement via said drive means.

6. The finisher as claimed in claim 1, further comprising a regulating member configured to prevent said reinforce roller from tilting when said reinforce roller moves on the fold of the stack while pressing said fold.

7. The finisher as claimed in claim 6, further comprising:

a support member supporting said reinforce roller;  
and

a stationary guide member configured to guide said support member in a direction perpendicular to the direction of sheet conveyance;

wherein said regulating member comprises a stationary guide adjoining a locus of movement of said support member and an elongate slot formed in said guide plate in parallel to said guide member and receiving part of said support member, whereby said reinforce roller is movable while being restricted in movement in a circumferential direction of said guide member.

8. The finisher as claimed in claim 6, wherein said guide member is formed with a corner for restricting the

movement of said support member in the circumferential direction of said guide member, so that said regulating member comprises said guide member.

9. The finisher as claimed in claim 6, wherein said guide member is polygonal in a section perpendicular to an axial direction of said guide member, so that said regulating member comprises said guide member.

10. The finisher as claimed in claim 6, wherein said guide member comprises two parallel guide members.

11. The finisher as claimed in claim 10, wherein said two guide members are mounted on said guide plate such that said support member is movable in a direction perpendicular to said guide plate.

12. The finisher as claimed in claim 11, further comprising biasing means for constantly biasing said support member toward said guide plate.

13. The finisher as claimed in claim 1, further comprising a regulating member configured to prevent a support member, which supports said reinforce roller, from tilting.

14. The finisher as claimed in claim 1, wherein when said reinforce roller is held in a stand-by position, a nip between said reinforce roller and said guide plate is positioned at a same height as the nip of said fold roller pair.

15. The finisher as claimed in claim 14, wherein said guide plate comprises:

supporting means for supporting said support member such that said support member is movable in an up-and-down direction perpendicular to the direction of sheet conveyance; and

biasing means for exerting a pressing force equal to, but opposite in direction to, a pressing force of said reinforce roller.

16. The finisher as claimed in claim 14, wherein said guide plate comprises a regulating member configured to prevent said reinforce roller from tilting when moving on and pressing the fold of the stack.

17. The finisher as claimed in claim 1, wherein part of said reinforce roller contacting the stack comprises a high friction member.

18. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a

direction perpendicular to a direction of sheet conveyance; and

control means for causing said reinforce roller to move at a lower speed when coming down from the stack onto said guide plate after pressing said stack than when pressing said stack, whereby an impact ascribable to contact of said reinforce roller with said guide plate is reduced.

19. The finisher as claimed in claim 18, wherein said control means lowers a moving speed of said reinforce roller not only during a forward movement but also during a backward movement.

20. The finisher as claimed in claim 18, further comprising a regulating member configured to prevent said reinforce roller from tilting when said reinforce roller moves on the fold of the stack while pressing said fold.

21. The finisher as claimed in claim 20, further comprising:

a support member supporting said reinforce roller;  
and

a stationary guide member configured to guide said support member in a direction perpendicular to the direction of sheet conveyance;

wherein said regulating member comprises a stationary guide adjoining a locus of movement of said

support member and an elongate slot formed in said guide plate in parallel to said guide member and receiving part of said support member, whereby said reinforce roller is movable while being restricted in movement in a circumferential direction of said guide member.

22. The finisher as claimed in claim 20, wherein said guide member is formed with a corner for restricting the movement of said support member in the circumferential direction of said guide member, so that said regulating member comprises said guide member.

23. The finisher as claimed in claim 20, wherein said guide member is polygonal in a section perpendicular to an axial direction of said guide member, so that said regulating member comprises said guide member.

24. The finisher as claimed in claim 20, wherein said guide member comprises two parallel guide members.

25. The finisher as claimed in claim 24, wherein said two guide members are mounted on said guide plate such that said support member is movable in a direction perpendicular to said guide plate.

26. The finisher as claimed in claim 25, further comprising biasing means for constantly biasing said support member toward said guide plate.

27. The finisher as claimed in claim 18, further comprising a regulating member configured to prevent a

support member, which supports said reinforce roller, from tilting.

28. The finisher as claimed in claim 18, wherein when said reinforce roller is held in a stand-by position, a nip between said reinforce roller and said guide plate is positioned at a same height as the nip of said fold roller pair.

29. The finisher as claimed in claim 28, wherein said guide plate comprises:

supporting means for supporting said support member such that said support member is movable in an up-and-down direction perpendicular to the direction of sheet conveyance; and

biasing means for exerting a pressing force equal to, but opposite in direction to, a pressing force of said reinforce roller.

30. The finisher as claimed in claim 28, wherein said guide plate comprises a regulating member configured to prevent said reinforce roller from tilting when moving on and pressing the fold of the stack.

31. The finisher as claimed in claim 18, wherein part of said reinforce roller contacting the stack comprises a high friction member.

32. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher

comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance;

a support member supporting said reinforce roller; and

a stationary guide member configured to guide said support member in a direction perpendicular to the direction of sheet conveyance;

wherein said drive means causes said reinforce roller to move along said guide member.

33. The finisher as claimed in claim 32, further comprising a bend-preventing member configured to prevent, when said reinforce roller presses the stack, said guide member from bending due to a pressing force of said reinforce roller.

34. The finisher as claimed in claim 33, wherein said bend-preventing member comprises:

a guide positioned at a side opposite to said guide plate with respect to said guide member and extending in



parallel to said guide member; and

a contact member mounted on an end of said support member remote from said reinforce roller and contacting said guide;

wherein said reinforce roller is movable with said contact member contacting said guide.

35. The finisher as claimed in claim 32, further comprising a regulating member configured to prevent said reinforce roller from tilting when said reinforce roller moves on the fold of the stack while pressing said fold.

36. The finisher as claimed in claim 35, further comprising:

a support member supporting said reinforce roller;  
and

a stationary guide member configured to guide said support member in a direction perpendicular to the direction of sheet conveyance;

wherein said regulating member comprises a stationary guide adjoining a locus of movement of said support member and an elongate slot formed in said guide plate in parallel to said guide member and receiving part of said support member, whereby said reinforce roller is movable while being restricted in movement in a circumferential direction of said guide member.

37. The finisher as claimed in claim 35, wherein said

guide member is formed with a corner for restricting the movement of said support member in the circumferential direction of said guide member, so that said regulating member comprises said guide member.

38. The finisher as claimed in claim 35, wherein said guide member is polygonal in a section perpendicular to an axial direction of said guide member, so that said regulating member comprises said guide member.

39. The finisher as claimed in claim 35, wherein said guide member comprises two parallel guide members.

40. The finisher as claimed in claim 39, wherein said two guide members are mounted on said guide plate such that said support member is movable in a direction perpendicular to said guide plate.

41. The finisher as claimed in claim 40, further comprising biasing means for constantly biasing said support member toward said guide plate.

42. The finisher as claimed in claim 32, further comprising a regulating member configured to prevent a support member, which supports said reinforce roller, from tilting.

43. The finisher as claimed in claim 42, wherein when said reinforce roller is held in a stand-by position, a nip between said reinforce roller and said guide plate is positioned at a same height as the nip of said fold roller

pair.

44. The finisher as claimed in claim 43, wherein said guide plate comprises:

supporting means for supporting said support member such that said support member is movable in an up-and-down direction perpendicular to the direction of sheet conveyance; and

biasing means for exerting a pressing force equal to, but opposite in direction to, a pressing force of said reinforce roller.

45. The finisher as claimed in claim 43, wherein said guide plate comprises a regulating member configured to prevent said reinforce roller from tilting when moving on and pressing the fold of the stack.

46. The finisher as claimed in claim 32, wherein part of said reinforce roller contacting the stack comprises a high friction member.

47. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets sequentially transferred from said image forming apparatus;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

shock absorbing means located at a contact position where said reinforce roller and said guide plate contact each other.

48. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets sequentially transferred from said image forming apparatus;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair

between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

control means for causing said reinforce roller to move at a lower speed when coming down from the stack onto said guide plate after pressing said stack than when pressing said stack, whereby an impact ascribable to contact of said reinforce roller with said guide plate is reduced.

49. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets sequentially transferred from said image forming apparatus;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a

direction perpendicular to a direction of sheet conveyance;

a support member supporting said reinforce roller;

and

a stationary guide member configured to guide said support member in a direction perpendicular to the direction of sheet conveyance;

wherein said drive means causes said reinforce roller to move along said guide member.

50. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular;

monitoring means for monitoring a movement of said reinforce roller; and

control means for causing, when an error is detected during movement of said reinforce roller, said reinforce roller to move to a home position and causing display means to display a jam message.

51. The finisher as claimed in claim 50, wherein said monitoring means comprises:

first sensing means for sensing the home position of said reinforce roller; and

second sensing means for sensing an end-of-reinforcement position where said reinforce roller ends pressing the fold.

52. The finisher as claimed in claim 50, wherein when said reinforce roller fails to return to the home position within a preselected period of time, said control means determines that said reinforce roller is fully locked and unable to return and that an error unable to be dealt with by a user has occurred, while causing said display means to display an error message.

53. The finisher as claimed in claim 50, wherein when the error has occurred, said control means inhibits said reinforce roller from pressing a following stack of sheets.

54. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets sequentially transferred from said image forming

apparatus;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular;

monitoring means for monitoring a movement of said reinforce roller; and

control means for causing, when an error is detected during movement of said reinforce roller, said reinforce roller to move to a home position and causing display means to display a jam message.

55. The system as claimed in claim 54, wherein said display means is included in said image forming apparatus.

56. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate; and



drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance;

wherein said drive means causes a moving speed of said reinforce roller to vary from a time when said reinforce roller contacts the stack to a time when said reinforce roller does not contact said stack.

57. The finisher as claimed in claim 56, wherein said drive means causes said reinforce roller to move at a lower speed when getting on the stack than when rolling on said stack.

58. The finisher as claimed in claim 57, wherein said drive means increases the moving speed of said reinforce roller to a preselected speed after said reinforce roller has got on the stack.

59. The finisher as claimed in claim 56, wherein assuming that said reinforce roller moves at a speed  $V1$  before getting on the stack, at a speed  $V2$  when getting on said stack, at a speed  $V3$  before coming down from said stack, at a speed  $V4$  when coming down from said stack and at a speed  $V6$  after coming down from said stack, then said drive means satisfies:

$$V1 \geq V2$$

$$V6 \geq V4$$

$V3 > V2, V4$

60. The finisher as claimed in claim 56, wherein said drive means causes said reinforce roller to move at a higher speed when the stack is absent than when said stack is present.

61. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets sequentially transferred from said image forming apparatus;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate; and

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance;

wherein said drive means causes a moving speed of said reinforce roller to vary from a time when said

reinforce roller contacts the stack to a time when said reinforce roller does not contact said stack.

62. In a sheet finisher for pressing a fold of a sheet stack folded for thereby reinforcing said fold, control means determines whether or not to execute processing for pressing said fold in accordance with a number of sheets constituting said sheet stack.

63. The finisher as claimed in claim 62, wherein when the number of sheets is equal to or larger than a preselected value, said control means executes said processing.

64. The finisher as claimed in claim 63, wherein said control means varies a number of times of pressing in accordance with the number of sheets.

65. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

control means for controlling said drive means;  
wherein said control means causes said reinforce roller to perform pressing in accordance with a number of sheets constituting the stack.

66. The finisher as claimed in claim 65, wherein said control means varies a moving speed of said reinforce roller during pressing in accordance with the number of sheets.

67. The finisher as claimed in claim 65, wherein said control means varies a number of times of pressing in accordance with the number of sheets.

68. The finisher as claimed in claim 65, further comprising sensing means positioned upstream of said reinforce roller in the direction of sheet conveyance for sensing the stack, wherein said control means causes said reinforce roller to continuously press the fold until said sensing means senses a following next stack of sheets.

69. The finisher as claimed in claim 68, wherein said control means varies a moving speed of said reinforce roller during pressing in accordance with the number of sheets.

70. The finisher as claimed in claim 65, wherein said control means varies a number of times of pressing in accordance with the number of sheets.

71. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to press a fold of a sheet stack for thereby reinforcing said fold and comprising control means for determining whether or not to execute processing for pressing said fold in accordance with a number of sheets constituting said sheet stack.

72. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to press a fold of a sheet stack folded for thereby reinforcing said fold and comprising control means for determining whether or not to execute processing for pressing said fold in accordance with a number of sheets constituting said sheet stack.

73. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold

of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

control means for controlling said drive means;

wherein said control means causes said reinforce roller to move to a position close to an edge of the stack to be pressed beforehand and wait at said position.

74. The finisher as claimed in claim 73, wherein said control means determines, when causing said reinforce roller to move to said position beforehand, a distance of movement in accordance with size information received.

75. The finisher as claimed in claim 74, wherein the distance of movement is selected to be two times as great as a distance between a stand-by position of said reinforce roller and a widthwise center of the stack to be pressed by said reinforce roller.

76. The finisher as claimed in claim 74, wherein the size information is received from an image forming apparatus from which the sheets are sequentially transferred to said finisher.

77. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with

input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets each carrying an image formed thereon;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

drive means for moving said reinforce roller in a direction perpendicular to a direction of sheet conveyance; and

control means for controlling said drive means;

wherein said control means causes said reinforce roller to move to a position close to an edge of the stack to be pressed beforehand and wait at said position.

78. A sheet finisher for folding a stack of sheets each carrying an image formed thereon, said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

first drive means for causing said reinforce roller to move in a direction perpendicular to a direction of sheet conveyance with an electric driving force; and

second drive means for allowing an operator to move said reinforce roller by hand.

79. The finisher as claimed in claim 78, wherein said first drive means comprises a motor, a drive pulley driven by said motor, a driven pulley and a belt passed over said drive pulley and said driven pulley, and

said second drive means comprises a lever connected to said driven pulley for allowing the operator to rotate said driven pulley by hand.

80. The finisher as claimed in claim 78, further comprising releasing means for releasing said reinforce roller from the stack at a pressing position.

81. The finisher as claimed in claim 80, wherein said releasing means comprises:

a first guide member supporting said reinforce roller such that said reinforce roller is capable of moving in a direction perpendicular to the direction of sheet conveyance;

a first shaft supporting said first guide member such that said first guide member is angularly movable about one end thereof; and

first locking means for selectively locking or



unlocking said first guide member at said pressing position.

82. The finisher as claimed in claim 81, wherein said first shaft comprises a shaft of said driven pulley.

83. The finisher as claimed in claim 81, wherein said first drive means is supported by said first guide member while said first shaft is included in said first guide member.

84. The finisher as claimed in claim 80, wherein said releasing means comprises:

a second guide member receiving a pressing force of said reinforce roller;

a second shaft supporting said second guide member such that said second guide member is angularly movable in a direction perpendicular to the direction of sheet conveyance; and

second locking means for selectively locking or unlocking said second guide member at a pressing position assigned to said reinforce roller.

85. The finisher as claimed in claim 80, wherein said releasing means comprises:

a second guide member receiving a pressing force of said reinforce roller;

a third shaft supporting said second guide member such that said second guide member is angularly movable

in a direction perpendicular to the direction of sheet conveyance; and

third locking means for selectively locking or unlocking said second guide member at a pressing position assigned to said reinforce roller.

86. An image forming system comprising:

an image forming apparatus comprising image forming means for forming an image on a sheet in accordance with input image data and sheet feeding means for feeding sheets to said image forming means one by one; and

a sheet finisher configured to fold a stack of sheets each carrying an image formed thereon;

said sheet finisher comprising:

a fold roller pair configured to fold the stack of sheets being conveyed via a nip thereof;

a reinforce roller configured to reinforce a fold of the stack of sheets folded by said fold roller pair between said reinforce roller and a guide plate;

first drive means for causing said reinforce roller to move in a direction perpendicular to a direction of sheet conveyance with an electric driving force; and

second drive means for allowing an operator to move said reinforce roller by hand.